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28.0 FOREIGN PIPELINE CROSSINGS

28.1 INTRODUCTION

This section relates to all foreign pipeline crossings and specifically addresses Trans-Alaskan Pipeline System (TAPS) crossings at both their mainline oil pipeline and fuel gas pipeline (FGL). Each crossing of TAPS will require a site specific design. The construction drawings will include such items as: insulation requirements, drainage and erosion controls, safety, access, daylighting, ditching, support of foreign pipeline, geometry and separation of pipelines, installation methods and backfill requirements, restoration, ground-water considerations, cathodic protection systems, signage as well as other items to ensure the safety and integrity of both pipeline systems. Other foreign pipeline crossings will be evaluated on the characteristics of the particular system and receive a design effort commensurate with each case.

Construction methods will be provided in specifications and construction plans. Access to TAPS during construction and operation is addressed in Section 7. A security plan will be developed which will be compatible with the operation of TAPS.

28.2 CODES AND CRITERIA

28.2.1 Codes

- Code of Federal Regulations, Title 18 – Conservation of Power and Water Resources
- Code of Federal Regulations, Title 49, Transportation, Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
- Federal Right-of-Way Grant for the Alaska Natural Gas Transportation System Alaska Segment, Serial No. F-24538 (December 1, 1980), as such may be updated and/or amended from time to time.
- Federal Energy Regulatory Commission conditional certificate of public convenience and necessity, issued on December 16, 1977, as such is finalized

28.2.2 Criteria

- Pipe wall thickness for TAPS crossings will be based on a 0.60 design factor, calculated according to 49 CFR 192. Limits to which this design factor will be applied are described in Section 3.
- The minimum clearance between the ANGTS pipeline and the buried TAPS pipeline will be three feet (See Figures 28.2. and 28.3) The minimum clearance between the ANGTS pipeline and all other foreign pipelines, including the TAPS FGL, will be 12 inches.
- The crossing angle between the ANGTS pipeline and TAPS will be between 60 and 120degrees. For any other foreign pipeline crossings, including the TAPS FGL, the

crossing angle is dependent on liaison with the foreign pipeline company and may be as low as 45degrees.

- For criteria on the ANGTS pipeline access road crossings of foreign pipelines, refer to Section 7.
- Alyeska Pipeline Service Company (APSC) shall be notified of construction activities on TAPS workpad and access roads, with the intent that the ability of APSC to respond to its Oil Spill Contingency Plan or to conduct normal operations shall not be impaired without APSC's prior agreement.
- Protective barricades, berms, or other devices will be placed as required to protect the crossed foreign pipeline from physical damage during the construction process (see Section 7). The crossed foreign pipeline will be monitored the entire duration of exposure until the crossing is completely backfilled.
- Wheel loads for various design elements are addressed in Sections 9, 14, and 20.

28.3 DESIGN PROCEDURES

28.3.1 Crossing Locations

- All crossing locations of foreign pipelines will be reviewed with and mutually agreed upon with the foreign pipeline owner.
- Crossing locations will be selected to have the minimum impact on the foreign pipeline being crossed. Where practical, crossings will be located in relatively flat terrain and in stable soils.
- Crossings of TAPS will be no closer than 120 feet from an existing anchor or a valve.

28.3.2 Crossing Design

- All aspects of the planned crossings that are likely to have a significant impact upon TAPS will be coordinated with APSC for the purpose of incorporating into the final design all necessary safeguards for the mutual protection of TAPS, TAPS FGL and the ANGTS pipelines.
- All TAPS crossings will be designed on a site specific basis according to the criteria in Sections 3 and 28 and other applicable sections of this document. Figures 28-1 through 28-4 indicate typical pipeline crossing plans.
- Geotechnical and geothermal analyses will be done for each crossing design. Items to be evaluated include:
  - Slope stability (static and dynamic)
  - Thaw settlement
  - Pipe/soil interaction at bends
  - Frost heave
  - Insulation requirements

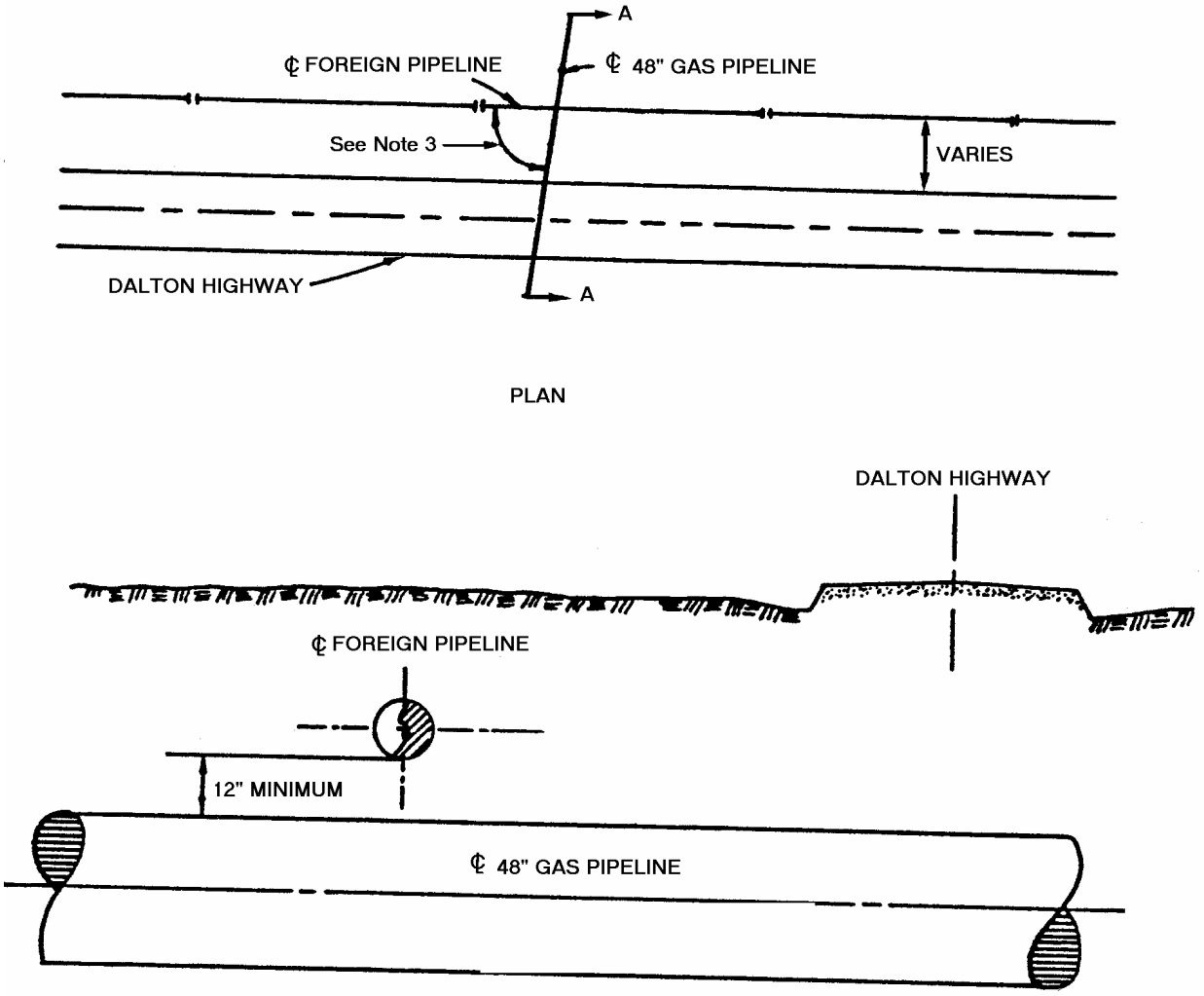
  - Thermal interaction between pipelines. For buried TAPS crossings, a thermal analysis will be made to evaluate the potential impact of the operating ANGTS pipeline on TAPS, especially should a shutdown of TAPS occur.

- Each crossing design will be evaluated to determine the impact that the ANGTS pipeline may have on surface water and groundwater conditions.
- Ditch plugs will be provided as required to protect both the ANGTS pipeline and the foreign pipeline from thermal/hydraulic erosion.
- The cathodic protection system for the ANGTS pipeline will be compatible with that of the foreign pipeline being crossed.
- Electrical bonding to foreign pipelines for corrosion control will be evaluated on a site-specific basis. Bonding is not generally recommended, and is dependent on liaison with the foreign pipeline company. Test points are recommended.
- Each foreign pipeline crossing will be identified with a marker, located as near as practical to the centerline of the ANGTS pipeline, at either end of the right-of-way limits or in a conspicuous location in the vicinity of the crossing.
- Drainage, erosion control and restoration will be in accordance with Section 11 and Section 12 with considerations to third party facilities.
- At crossings where TAPS is below ground (See Figures 28-2 and 28-3) the following will apply:
  - Crossings will be designed for the heaviest anticipated construction.
  - Where the ANGTS workpad passes over belowground TAPS, minimum cover of 5 feet will be provided. Stress calculations will be performed to verify the minimum cover requirements to maintain integrity of TAPS. (See Section 20)
  - Crossings beneath the belowground TAPS pipeline will be designed to ensure complete restraint and support of the TAPS pipeline during ANGTS pipeline installation.
  - Crossing above the belowground TAPS pipeline will likely incorporate construction of berms to restrain and support the ANGTS pipeline. Berm dimensions, including height, top width, pipe cover, and slopes, will be determined on a site-specific basis to adequately restrain the ANGTS pipeline (not sure that crossing above a buried TAPS is advisable unless TAPS is abnormally deep, say 10 feet minimum from grade to top of TAPS).
- At crossings where TAPS is aboveground the following will apply:
  - TAPS will be crossed by installing the ANGTS pipeline near the midpoint of the aboveground span.
  - Minimum excavation clearance from Vertical Support Members (VSMs) will be 15 feet. Thawing of the frozen bulb supporting the TAPS VSMs will be prevented.

  - The ANGTS pipeline workpad will only cross TAPS where sufficient clearance exists. Barriers and "headache" bars will be provided to protect TAPS.
  - If equipment access under TAPS is prohibited at the point of crossing, then barriers will be provided to prevent equipment crossing.
  - Site-specific clearances will be established and mutually agreed upon with APSC for each crossing.
- Site-specific designs will be submitted for floodplain crossings. The design will consider the existing design and field conditions as well as related floodplain structures. Any additional floodplain structures or modification of existing structures will be designed as outlined in Section 16.

28.4 FIGURES AND TABLES

LIST OF FIGURES



Section A-A

Figure 28-1 Typical Foreign Pipeline Crossing, Including TAPS Fuel Gas Pipeline Crossing

Notes:

1. *Within 5' of foreign pipelines, excavation will be by hand prior to mainline excavation by machine.*
2. *Following installation of the pipeline, all foreign pipelines, insulation, and appurtenances will be restored to their pre- crossing condition. Geothermal analysis may require mitigation such as additional insulation.*
3. *Angle of intersection between pipelines will be between 45° and 135°*
4. *For depth of burial and design criteria within highway Right-Of-Way See Section 15*

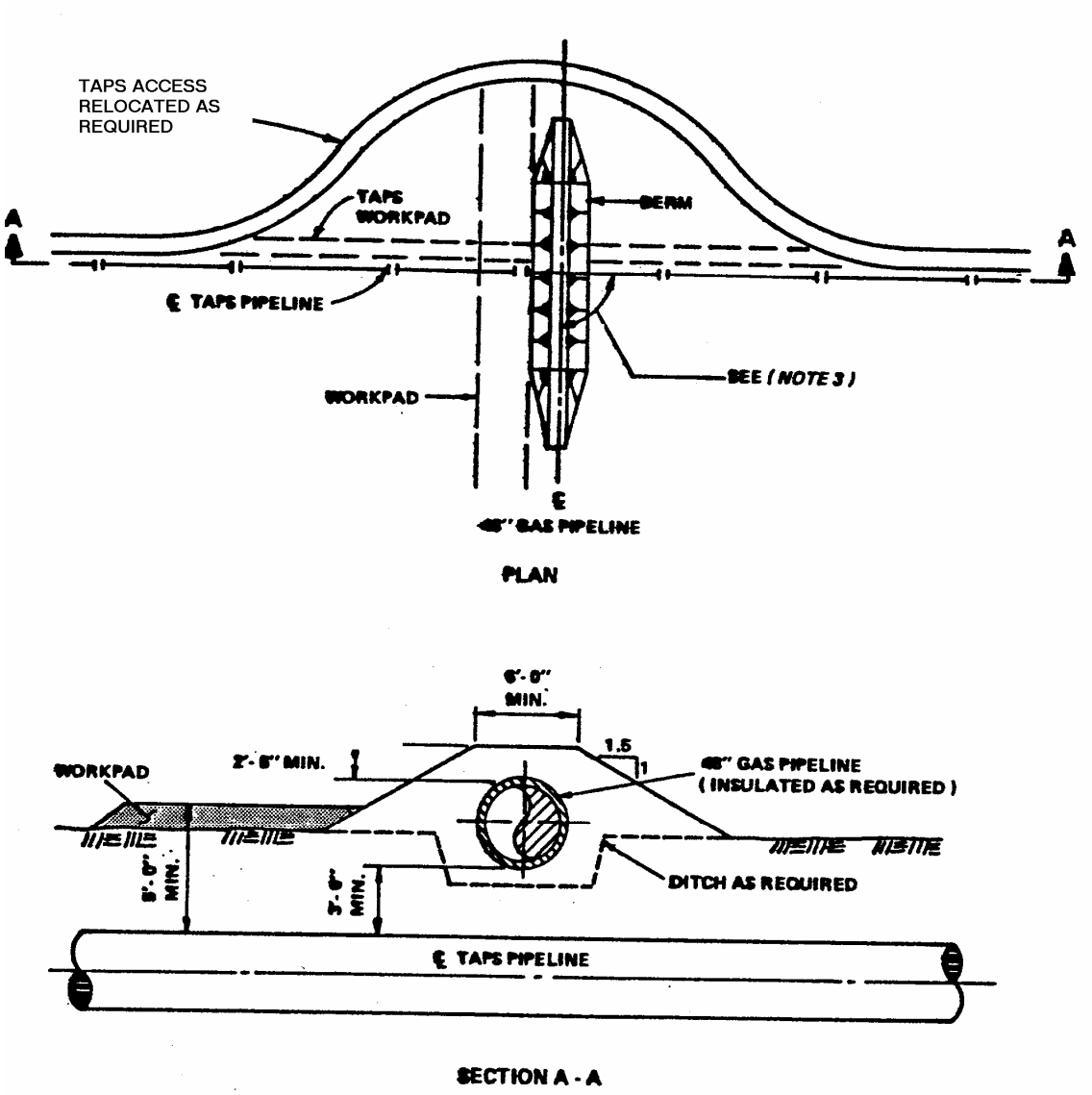


Figure 28-2 Typical Crossing TAPS Pipeline belowground (above TAPS)

Notes:

1. *Access to TAPS will be provided during construction.*
2. *Angle of intersection between pipelines will be between 60° to 120°.*
3. *Depending on actual site specific burial depth of TAPS, the berm may be eliminated.*
4. *Berm material will be non-frost susceptible granular fill.*
5. *Frost susceptible material under the berm will be over excavated and replaced with non-frost susceptible granular fill.*
6. *Within 5' of TAPS pipe, excavation will be by hand.*

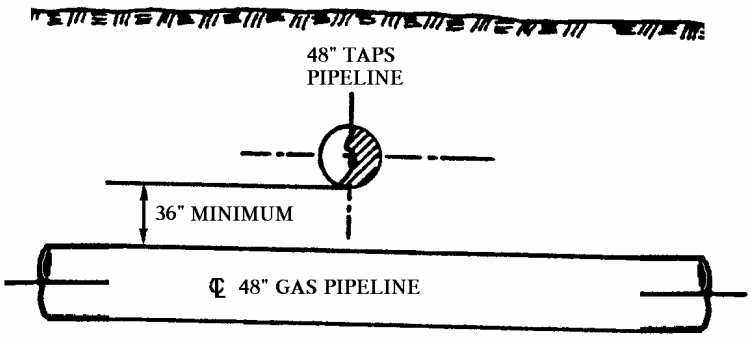


Figure 28-3 Typical Crossing TAPS Pipeline Belowground (Below TAPS)

Notes:

1. *Access to TAPS will be provided during construction.*
2. *Angle of intersection between pipelines will be between 60° to 120°.*
3. *Within 5' of TAPS pipe, excavation will be by hand.*

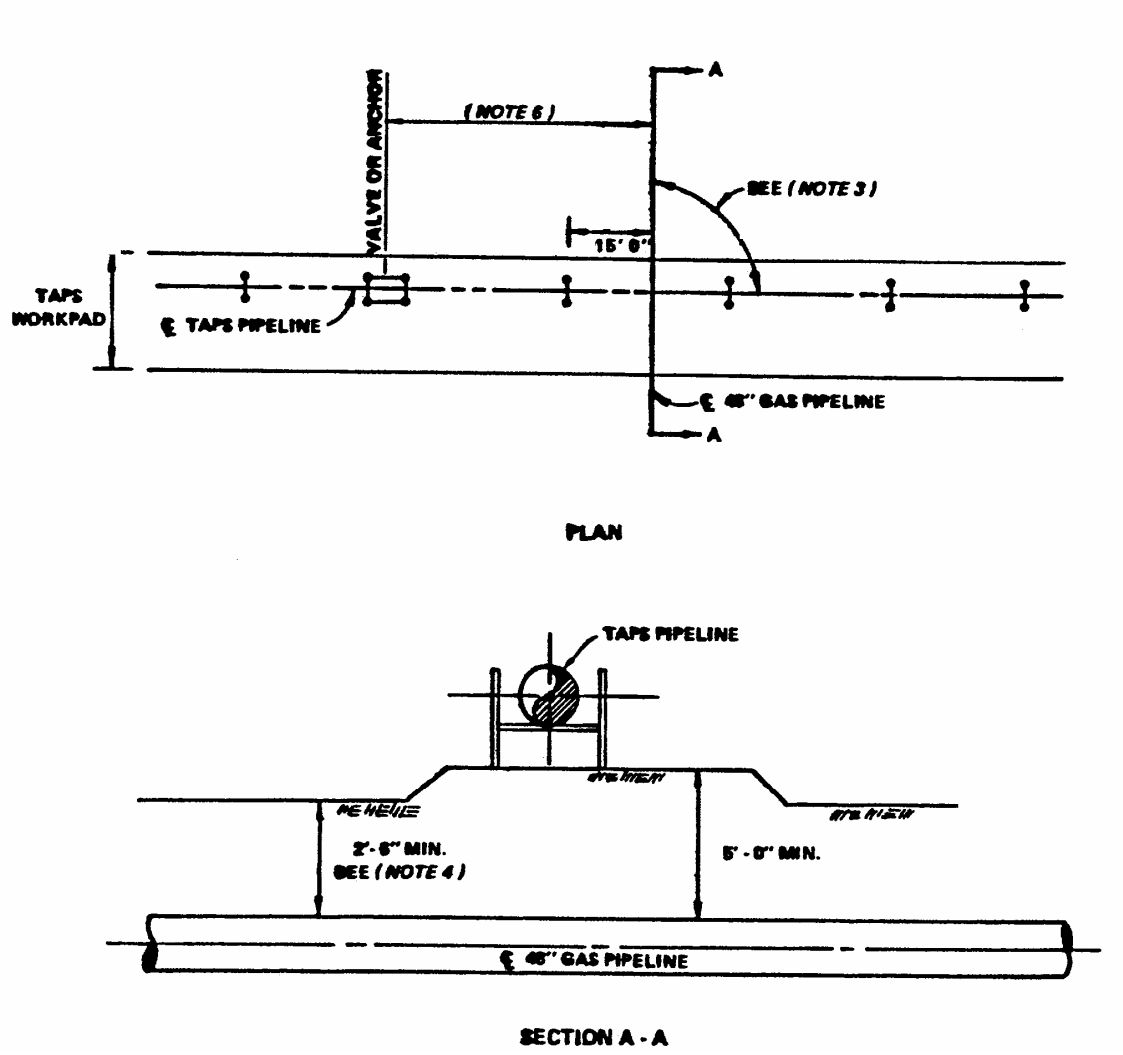


Figure 28-4 Typical Crossing TAPS Pipeline Aboveground

Notes:

1. *Access to TAPS will be provided during construction.*
2. *Angle of intersection between pipelines will be between 60° to 120°.*
3. *2'-6" minimum to cover in TYPE II ditch includes workpad extension in areas where the TAPS fuel gas pipeline is present. See Figure 28-1 (Typical TAPS fuel gas pipeline crossing) for minimum requirements.*
4. *TAPS pipeline workpad will be restored to its pre- crossing condition, including insulation where applicable.*
5. *Crossing to be a minimum 120' from existing anchors or valves on TAPS pipe.*